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Proceedings of the PSARC Invertebrate Subcommittee Meeting June 17-19, 2003

Compte rendu de la réunion du sous-comité des invertébrés du CEESP, 17-19 juin 2003

June 17-19, 2003
Nanaimo, B.C.

K. West
Invertebrate Subcommittee Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)
INVERTEBRATE SUBCOMMITTEE MEETING

SUMMARY 2

SOMMAIRE 3

INTRODUCTION 5

General Subcommittee Discussion and Concerns 6

DETAILED COMMENTS FROM THE REVIEWS 6

I2003-01: Progressing to a scientifically-based assessment and management system for renewed commercial pink and spiny scallop fisheries off the British Columbia coast 6

I2003-02: Assessment of green sea urchin (*Strongylocentrotus droebachiensis)* stocks in British Columbia, 2003 8

I2003-03: Utility of Historical Catch to Set Reference Points for the British Columbia Shrimp by Trawl Fishery 9

I2003-04: Development of a new fishery for tanner crabs (*Chionoecetes tanneri Rathbu, 1893*) off British Columbia: 2003 status report 11

STOCK STATUS REPORTS 12

APPENDIX 1: WORKING PAPER SUMMARIES 13

APPENDIX 2: PSARC INVERTEBRATE SUBCOMMITTEE MEETING AGENDA JUNE 17-19, 2003 16

APPENDIX 3: LIST OF ATTENDEES & REVIEWERS 17

SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Invertebrate Subcommittee met June 17-19, 2003 at the Pacific Biological Station in Nanaimo, B.C. The Subcommittee reviewed four working papers and one stock status report.

Working Paper I2003-01: Progressing to a scientifically-based assessment and management system for renewed commercial pink and spiny scallop fisheries off the British Columbia coast

This paper reports on the results of the experimental fisheries, surveys and assessments for the pink and spiny scallop fisheries in B.C. In addition, it presents options on actively assessing and managing these stocks. The Subcommittee supported further work on the development of the trawl and dive commercial scallop fisheries. Progression to the next stage would depend on meeting the criteria for new and developing fisheries. They saw the merits of having consistent size limits by species for both gear types; however felt the paper itself did not contain sufficient supporting material to justify a change in size limit at this time. The Subcommittee supported the recommendation that revised harvest rates of 8% of unexploited and 4% of exploited legal-sized biomass be used to determine Total Allowable Catch's (TAC's) in both the dive and trawl fisheries. It was agreed that assessment and management for these species be conducted on the finest geographical scale possible and that detailed growth studies be conducted to investigate minimum size limits for spiny scallops and to review the existing data for pink scallops.

Working Paper I2003-02: Assessment of Green Sea Urchin (*Strongylocentrotus droebachiensis*) stocks in British Columbia, 2003

The objectives of this paper were to provide an analysis of the British Columbia green sea urchin fishery, provide harvest yield recommendations, and present results from fishery independent surveys. The calculations of limit reference points for green sea urchins (GSU) in South Coast management areas were derived using the time series model. A range of target reference points (quota options) for the 2003-2004 and 2004-2005 fishing seasons were presented (Table 1). The Subcommittee recommended the continued use of the time series model to assess GSU stocks in British Columbia in conjunction with the Bayesian model and supported the range of target yield options outlined in the paper. The Subcommittee concluded that MSY should be considered as a limit reference point rather than a target reference point. In addition, the Subcommittee supported the proposal to continue to collect biomass and biological data through fishery-independent surveys.

Working Paper I2003-03: Utility of Historical Catch to Set Reference Points for the British Columbia Shrimp by Trawl Fishery

This paper focused on the utility of using historical catch to set biological reference points for managing the shrimp by trawl fishery. It discussed the biological reference

point models and the assumptions needed to be met when using historical catch data as an input parameter for reference point models. The Subcommittee recognized that historic commercial shrimp trawl catch data is not an appropriate proxy for shrimp abundance in reference point models. The Subcommittee recognized that the nature of the shrimp trawl fishery had changed over time and the ability of the fleet to target specific size and shrimp species had increased. The Subcommittee emphasized the need for science based assessments in the shrimp trawl fishery. The Subcommittee recommended that 1) fishery-independent surveys continue to estimate shrimp abundance for reference point models and monitor shrimp stocks 2) that these surveys must continue on a consistent basis in key index sites, and, 3) that investigations continue using abundance data from surveyed index sites to extrapolate biomass estimates for unsurveyed areas. The Subcommittee agreed with the concern about the possible effect of size and species targeting on the population structure in areas with arbitrary catch ceilings.

Working Paper I2003-04: Development of a new fishery for tanner crabs (*Chionoecetes tanneri* Rathbun, 1893) off British Columbia: 2003 status report

This paper presented an update of the efforts to assess and develop a directed fishery for Tanner crab on the west coast of B.C. It was concluded by the Subcommittee that a time series of indices of abundance for Tanner crab was required and that these biomass estimates would be improved by the use of swept area trawl and trap catch surveys. The Subcommittee concurred that the experimental trap harvest for Tanner crab be restricted to the west coast of Vancouver Island (PFMAs 123 to 126). The Subcommittee emphasized that an ecological approach to the assessment and management of all deepwater fisheries was imperative. They felt that the overall impact of all trawl and trap fisheries on Tanner crab should be evaluated and the potential for incorporating a targeted Tanner crab trap fishery on the WCVI should be investigated. The Subcommittee supported further work on the development of this fishery.

SOMMAIRE

Le sous-comité des invertébrés du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni du 17 au 19 juin 2003 à la Station biologique du Pacifique, située à Nanaimo, en Colombie-Britannique, pour passer en revue quatre documents de travail et un rapport sur l'état des stocks.

Document de travail I2003-01 : Vers un système d'évaluation et de gestion scientifiques pour les pêches commerciales renouvelées du pétoncle rose et du pétoncle épineux au large de la Colombie-Britannique

Ce document présente les résultats des pêches expérimentales, des relevés et des évaluations des pêches du pétoncle rose et du pétoncle épineux en C.-B., ainsi que des options pour évaluer et gérer ces stocks. Le sous-comité est d'avis que le développement des pêches commerciales du pétoncle au chalut et en plongée doit

faire l'objet d'autres travaux. Si les critères pour les pêches nouvelles et émergentes sont satisfaits, on pourra passer à la prochaine étape. Le sous-comité estime qu'il est utile d'avoir les mêmes limites de taille pour chaque espèce pour les deux types d'engin, mais il est d'avis que le document ne présente pas suffisamment de renseignements pertinents pour justifier la modification des limites de taille à ce moment-ci. Le sous-comité adhère à la recommandation à l'effet que des taux de récolte révisés se chiffrant à 8 % dans le cas de la biomasse non exploitée de pétoncles de taille réglementaire et à 4 % dans le cas de la biomasse exploitée soient utilisés pour calculer le total autorisé des prises (TAC) au chalut et en plongée. Il a aussi convenu que l'évaluation et la gestion de ces espèces se fassent sur la plus petite échelle géographique possible et que des études approfondies de la croissance soient effectuées en vue d'établir les limites de taille minimum pour le pétoncle épineux et de passer en revue les données disponibles sur le pétoncle rose.

Document de travail I2003-02 : Évaluation des stocks d'oursin vert (*Strongylocentrotus droebachiensis*) en Colombie-Britannique en 2003

Ce document présente une analyse de la pêche de l'oursin vert pratiquée en Colombie-Britannique, des recommandations relatives au rendement de la pêche et les résultats de relevés indépendants de la pêche. Le calcul des points de référence limites pour l'oursin vert des zones de gestion de la côte Sud repose sur le modèle en série chronologique. Une plage de points de référence cibles (options de quotas) pour les saisons de pêche 2003-2004 et 2004-2005 est aussi présentée. Le sous-comité recommande que l'on continue d'utiliser le modèle en série chronologique pour évaluer les stocks d'oursin vert de la Colombie-Britannique parallèlement avec le modèle bayésien et approuve la gamme des options de rendement cibles présentées. Il conclut que le REM devrait être considéré comme un point de référence limite plutôt qu'un point de référence cible et il appuie la proposition à l'effet de continuer à recueillir des données sur la biomasse et la biologie de l'espèce par le biais de relevés indépendants de la pêche.

Document de travail I2003-03 : Utilité des données historiques sur les prises pour établir des points de référence biologique pour la pêche de la crevette au chalut en Colombie-Britannique

Ce document porte sur l'utilité d'utiliser des données historiques sur les prises pour fixer des points de référence biologique aux fins de gestion de la pêche de la crevette au chalut. Il présente les discussions sur les modèles de points de référence biologique et les hypothèses qui doivent être satisfaites lorsqu'on utilise des données historiques sur les prises comme paramètre d'entrée dans les modèles. Le sous-comité reconnaît que les données historiques sur les prises commerciales de crevette au chalut ne sont pas un indicateur approprié de l'abondance de la crevette dans ces modèles. Il est en outre conscient du fait que la nature de cette pêche a changé au fil des ans et que la capacité de la flottille de cibler des tailles et des espèces de crevette spécifiques a augmenté. Il insiste sur le besoin de faire des évaluations scientifiques de la pêche de la crevette au chalut et recommande ce qui

suit : 1) que l'on continue à faire des relevés indépendants de la pêche pour estimer l'abondance de la crevette aux fins d'inclusion dans les modèles des points de référence et de surveillance des stocks 2) que ces relevés doivent continuer d'être faits régulièrement aux sites repères clés et 3) que l'on continue d'utiliser les données sur l'abondance aux sites repères prospectés pour faire des extrapolations de la biomasse estimée aux endroits non prospectés. Le sous-comité est préoccupé aussi par l'effet que peut avoir sur la structure des populations la concentration de l'effort de pêche sur des tailles et une espèce particulières dans les régions où les plafonds des prises ont été fixés de façon arbitraire.

Document de travail I2003-04 : Développement d'une nouvelle pêche du crabe des neiges du Pacifique (*Chionoecetes tanneri* Rathbun, 1893) au large de la Colombie-Britannique : rapport sur l'état des stocks de 2003

Ce document fait le point sur les efforts d'évaluation et de développement d'une pêche dirigée du crabe des neiges du Pacifique en Colombie-Britannique. Le sous-comité conclut qu'une série chronologique d'indices d'abondance du crabe des neiges est requise et que des relevés au chalut et au casier reposant sur la méthode des aires balayées permettraient d'améliorer les estimations de la biomasse. Il est d'accord que la pêche expérimentale du crabe au casier ne soit autorisée que sur la côte Ouest de l'île de Vancouver (secteurs d'exploitation des pêcheries du Pacifique 123 à 126). Le sous-comité insiste qu'il est impératif que l'on adopte une approche axée sur l'écologie pour évaluer et gérer toutes les pêches en eau profonde. Il est en outre d'avis que l'impact global de toutes les pêches du crabe des neiges au chalut et au casier devrait être évalué et que l'intégration potentielle d'une pêche dirigée de l'espèce au casier sur la COIV devrait être examinée. Le sous-comité est d'avis que le développement de cette pêche devrait être l'objet d'autres études.

INTRODUCTION

The PSARC Invertebrate Subcommittee met June 17-19, 2003, at the Pacific Biological Station in Nanaimo, British Columbia. External participants from the West Coast Green Sea Urchin Association, West Coast Scallop Harvesters Association and the Haisla Fisheries Commission attended the meeting. The Subcommittee Chair, K. West, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda.

The Subcommittee reviewed four Working Papers. Summaries of the Working Papers are in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants, observers and reviewers is included as Appendix 3.

General Subcommittee Discussion and Concerns

The Subcommittee discussed the scheduling and review of PSARC stock status reports (SSR's) and agreed that 1) a schedule for stock status reports be

implemented and 2) that the review of the SSR's be achieved by circulation to Subcommittee members for comments. The goal would be to have an SSR on record for all harvested species and species of interest.

DETAILED COMMENTS FROM THE REVIEWS

I2003-01: Progressing to a scientifically-based assessment and management system for renewed commercial pink and spiny scallop fisheries off the British Columbia coast

R.B. Lauzier, L.C. Walthers, W. Hajas, J. Lessard, E. Wylie

This paper presented a review of the experimental phase in the precautionary framework for new and developing invertebrate fisheries and reviewed the experimental pink and spiny scallop dive and trawl fisheries of the past two years. Analyses of biological data collected through survey efforts and fishery dependent data collected through the experimental fisheries were presented. The objectives of the paper were 1) to define limit and target reference points through Scallop Assessment and Management (SAM) area-specific biomass estimates and 2) to summarize the data collected to date and identify on-going assessment requirements. Further development of the trawl and dive commercial scallop fisheries would depend on meeting the criteria for the new and developing fisheries.

Both reviewers felt a more thorough analysis needed to be presented to support the change in size limit. One reviewer questioned the appropriateness of the model selected to develop the harvest rates. The authors recognize the limitations of the model and the need to improve as more data is collected.

Conclusions

The Subcommittee discussed the limitations of the Gulland model to calculate harvest rate, but concluded that use of the model was an acceptable starting point which will be improved upon as more data become available and different models can be used. The rationale behind using the limit reference point of 50% of the virgin biomass estimates calculated from the Gulland model was questioned by the Subcommittee and it was suggested that the same rule may not apply to all populations. The Subcommittee did support that the most appropriate target reference point for the scallop fisheries, at this time, is a harvest rate derived from the Gulland model. A target harvest rate of 8% of unexploited and 4% of exploited legal-sized biomass were deemed appropriate for use to determine TAC's in the fishery.

There was considerable discussion by the Subcommittee on whether the recommended reduction in size limit for pink scallops from 55 mm to 50 mm was supported by data or logic. The Subcommittee recognized that the original size limits for both pink and spiny were arbitrary numbers by gear (55cm for both in dive, 48cm in trawl), but felt that a change in size limit required more detailed supporting

documentation. The Subcommittee could see the merit in having consistent size limits for both gear types to reduce pressure on the larger spiny scallops and to lower discard rates on undersized scallops. The paper itself did not contain sufficient material to support the recommendation to decrease the size limit for pink scallops.

The Subcommittee supported further work on the development of this fishery and to proceed using the phased approach for new and developing fisheries. However, the Subcommittee could not come to a consensus that all the necessary information for an assessment framework was available to proceed to the next phase of this fishery.

It was agreed that the schedule for biomass surveys should be developed based on decision rules. This would be done in collaboration with industry and take into consideration landings as a portion of revised recommended harvest levels, age structure of local stocks, timing of the last biomass survey and integration of surveys with any proposed rotational harvest plan.

The Subcommittee commented on the need for accurate catch reporting as this fishery develops.

Subcommittee Recommendations

The Subcommittee accepted the paper subject to revisions.

1. The Subcommittee accepted the paper's recommendation that harvest continue to be limited and that fisheries continue to develop in the phased approach of new and developing fisheries.
2. The Subcommittee recommended that assessment and management of the pink and spiny scallop fisheries be conducted on the finest geographical scale possible.
3. The Subcommittee recommended that a larger sample be collected at each major harvest location for the determination of biological parameters and further recommended that gonad condition data be collected.
4. The Subcommittee recommended that revised harvest rates of 8% of unexploited and 4% of exploited legal biomass be used to determine TAC's in the fishery.
5. The Subcommittee supported the decision rules presented in the paper for scheduling biomass surveys.
6. The Subcommittee recommended that further analysis is required for biologically based size limits and accepted the recommendation in the Working Paper that growth studies be conducted to investigate minimum size limits for spiny scallops.

I2003-02: Assessment of green sea urchin (*Strongylocentrotus droebachiensis)* stocks in British Columbia, 2003

R.I. Perry, Z. Zhang, B.J. Waddell **Accepted subject to revisions**

This paper examined the 2003 assessment of Green Sea Urchin (GSU) stocks in British Columbia. The specific objectives addressed were: 1) update historical catch monitoring information with the data collected in the 2001 & 2002 harvest seasons; 2) provide recommendations for harvest yield for 2003/2004 & 2004/2005 harvest seasons; and, 3) present results of fishery independent GSU surveys.

One reviewer noted the benefits of using the Bayesian method to assess GSU stocks. The reviewer noted that the Bayesian method incorporates both the uncertainties in CPUE and the catch reported in the initial nine years of information, as well as incorporates the data collected from fishery independent surveys. The second reviewer questioned the authors' development of their own software to perform Markov Chain Monte Carlo (MCMC) calculations given the potential for generating errors. The reviewer suggested that improvements to the Bayesian approach may be accomplished through more attention to the model's structure. The reviewer requested clarification as to the authors' intentions in reducing the margin of error - were they attempting to reduce uncertainty in the CPUE or if they were attempting to incorporate it. The reviewer asked for clarification as to why the time series model was chosen to develop quota options rather than the Bayesian method.

Conclusions

Based on the authors' explanation, the Subcommittee agreed with the proposed use of the time series model in conjunction with the Bayesian model. The time series model has been historically used to assess the GSU stocks and will also allow a source of comparison to verify the consistency of the Bayesian model. The Bayesian model will be worthwhile to continue as it incorporates the uncertainty of both catch data and the method of calculation and likely shows the true risks of estimating MSY. The Subcommittee also noted a need to define the cause of potential variation in GSU populations.

The Subcommittee suggested that the quota options be presented with the associated level of risk and an explanation of that risk. Level of risk for yield options will be applied in South Coast Inside waters, north and south. The Subcommittee felt that a table of yield vs. risk would be a more accurate tool than the formula provided in the paper for GSU Managers.

The Subcommittee noted that incorporating an egg production model such as used in other urchin assessments, may be a method for future assessment of GSU to increase the current model's efficiency.

Subcommittee Recommendations

The Subcommittee accepted the paper subject to minor revisions.

1. The Subcommittee recommended that the time series model continue to be used to assess GSU stocks in British Columbia in conjunction with the Bayesian model.
2. The Subcommittee concurred with the recommendation that MSY be considered the limit reference point.
3. The Subcommittee supported the range of quota options as outlined in the paper (Table 1) as target reference points and recommended that the implications each quota option be added to the table to allow an evaluation of risk to the resource.
4. The Subcommittee concurred with the recommendations that fishery-independent surveys continue in Area 12, that a suitable working site should be selected to continue annual surveys in the Gulf Islands, and that experimental studies on growth rates and age determination should continue.

I2003-03: Utility of Historical Catch to Set Reference Points for the British Columbia Shrimp by Trawl Fishery

D.T. Rutherford, L.L. Barton, G.E. Gillespie, J.A. Boutillier **Accepted subject to revision**

This paper focused on the limited utility of using historical catch and the importance of survey data to set biological reference points for managing the shrimp by trawl fishery. It discussed four key points: 1) the biological reference point models and the assumptions that need to be met when using the historical catch data in these models, 2) the information constraints associated with historical shrimp trawl commercial data, 3) the current assessment framework and annual fluctuations in shrimp biomass, and 4) the shortcomings of abandoning the assessment framework and using only historical catch data to ensure stock conservation. It also demonstrated the shortcomings and pitfalls of abandoning science based assessments and using only historical catch to ensure stock conservation in the shrimp trawl fishery.

Both reviewers felt that the paper did not fully address all of the questions posed in the request for working paper (RWP), although both did note that the quantity of information may not exist to adequately answer all questions posed. One reviewer expected, based on the RWP, to see some modeling of the implications of using the historical data. The authors noted that only five to six years of fishery independent data exist. One reviewer also noted that they would have liked to have seen a more detailed discussion of risks associated with other management options. The other reviewer noted that it would be useful to include a description of how catch ceilings are adjusted in season following surveys. In addition, this reviewer also commented

that that there were no estimates of uncertainty or variability provided for the fishery independent estimates of shrimp biomass.

Conclusions

The Subcommittee agreed with the authors that the current utility of historical catch as a proxy for abundance is not appropriate. The Subcommittee agreed that fishing practices where certain size or species are targeted is a concern and need to be taken into account when managing this fishery. The Subcommittee highlighted the need for the discussion of the arbitrary catch ceilings set in 1997 in the paper.

The Subcommittee noted that the frequency and analysis of fishery independent surveys in this fishery have been compromised due to reduced funding. The Subcommittee concluded that regular surveys are needed to: estimate shrimp abundance by species and age, set catch ceilings, monitor long-term trends in shrimp stock abundance, develop risk assessment, and provide information not available from commercial catch data.

The Subcommittee is concerned that without annual surveys the Stock Assessment Division will be unable to provide scientifically defensible biomass forecasts for the shrimp trawl fishery.

Developing accurate models and determining minimum biomass thresholds are not possible at this time with the data available, however future assessments should work towards both those objectives as additional data becomes available. The Subcommittee concluded that confidence intervals around the biomass estimates need to be developed. This may result in the use of different models and a change in the survey design.

Subcommittee Recommendations

The paper was accepted subject to minor revisions.

1. The Subcommittee supported the recommendation that the current utility of historic commercial shrimp trawl catch data as a proxy for shrimp abundance is not appropriate in reference point models.
2. The Subcommittee recommended that surveys continue to estimate shrimp abundance for reference point models and to monitor shrimp stocks. It is important that these surveys continue on a consistent basis in key index sites.
3. The Subcommittee recommended the investigation of methods to calculate confidence limits around the biomass estimate.
4. The Subcommittee supported the continued investigation of extrapolating abundance data from surveyed index sites to calculate biomass estimates for un-surveyed areas.

5. The Subcommittee noted that the ability of the shrimp trawl fleet to target size and shrimp species, and the effects this may have on population structure in areas with arbitrary catch ceilings, is a concern and should be investigated.

I2003-04: Development of a new fishery for tanner crabs (*Chionoecetes tanneri Rathbu, 1893*) off British Columbia: 2003 status report

G.E. Gillespie, K.H. Fong, A.C. Phillips, G.R. Meyer, J.A. Boutillier **Accepted subject to revisions**

This paper analyzes the information on deep-water tanner crab gathered since the phase 1 report, identifies information needs, and presents proposals for future work to meet these information needs. The distribution and abundance of Tanner crabs has been estimated for the entire B.C. coast. In general, relative abundance increases from the B.C. – Washington border to peak abundance off the central and northern portions of West Coast Vancouver Island (WCVI), and then decreases in Queen Charlotte Sound and off the west coast Queen Charlotte Islands. Fisheries and Oceans Canada (DFO) trawl surveys and experimental fisheries have been conducted since 1999/2000.

One reviewer found no major omissions or errors and thought the paper was a thorough update. The second reviewer did not recommend acceptance and felt the paper needed major condensing and review of recommendations. The lack of discussion in the paper on the potential for the Tanner crab biomass to support an economical, sustainable fishery was brought up by one reviewer and generated discussion by the Subcommittee.

Conclusions

The Subcommittee concluded that a significant bycatch of deep water tanner crab occurred in the Thornyhead trawl fishery. The trawl by-catch of tanner crab exceeded preliminary tanner crab catch ceilings in some areas.

There was concern that a designation of PFMA 127 as an unexploited control area would have little value if the impact of other fisheries (groundfish trawl for Thornyhead and trap for sablefish) on the tanner crab population was not considered. Any area farther south was deemed not viable due to previous impacts to the tanner crab stocks by the trawl fishery. The Subcommittee concluded that co-operation between sectors was imperative to the success of any directed tanner crab fishery.

It was also discussed that there was little biological basis for considering the closed areas as refugia - a population reservoir for mitigating possible fishery impacts. Increased biological knowledge (e.g. larval dispersal) might better define the potential for refugia.

The high observed catch of females was noted as a concern as it has increased over recent years. The Subcommittee concluded that gear modifications or seasonal/area closures designed to avoid the catch of females needs to be investigated. Trap gear modification on any large scale was deemed expensive, with few resources available to test new trap designs.

Recommendations

The Subcommittee accepted the paper subject to revision.

1. The Subcommittee supported the recommendation that annual assessments and related surveys be developed to begin a time series of indices of abundance for Tanner crab. The Subcommittee also supported the recommendations for improving estimates by swept area trawl and trap catch and the use of two sources of data for a more robust assessment.
2. The Subcommittee recommended that the experimental trap harvest should be restricted to the west coast of Vancouver Island in PFMAs 123 to 126. PFMA 125 should be fished more aggressively than the other areas, with a TAC of 100t, while the other areas would have more conservative TAC's. This represents an increase in opportunity over previous years.
3. The Subcommittee expressed concern that the deepwater Thornyhead trawl fishery has a significant bycatch of Tanner crab. The Subcommittee reiterates previous recommendations that an ecological approach is necessary for the assessment and management of all deepwater fisheries. The overall impact of trawl and trap fisheries should be evaluated and the potential for incorporating a Tanner crab trap fishery on the WCVI should be identified.
4. The Subcommittee supports further work on the development of a Tanner crab fishery. This may include continued studies to examine productivity, gear selectivity, response to fishing pressure, and discard mortality.

Stock Status Reports

One stock status report was reviewed and approved by the Subcommittee on Green Sea Urchin. Once reviewed and approved these stock status reports are forwarded to the PSARC Secretariat for publication in the usual manner.

APPENDIX 1: Working Paper Summaries

Working Paper I2003-01: Progressing to a scientifically-based assessment and management system for renewed commercial pink and spiny scallop fisheries off the British Columbia coast

R.B. Lauzier, L.C. Walthers, W. Hajas, J. Lessard, E. Wylie

This document reviews the experimental pink and spiny dive and trawl scallop fisheries of the past 2 years in British Columbia waters. Biological data collected during the surveys and experimental fisheries show each species has different growth characteristics, and there are reduced growth rates in northern in comparison to southern waters. Survey methods were developed for each fishery, and the results of surveys are presented. The results of the experimental fisheries are presented and compared to the recommended harvest options. Natural mortality rates have been revised, resulting in a revision of recommended harvest rates. Issues of concern raised during the initial review on abundance and distribution of scallop stocks, sustainability and viability of the trawl fishery, assessment of fishing characteristics of the scallop trawl, localized depletions have been addressed. Assessment and management options have been made on progressing to limited commercial fisheries. Recommendations are made on assessment programs and management measures for limited commercial fisheries.

Working Paper I2003-02: Assessment of Green Sea Urchin (*Strongylocentrotus droebachiensis*) stocks in British Columbia, 2003

R.I. Perry, Z. Zhang, B.J. Waddell

This paper *(i)* provides an analysis of the green sea urchin fishery in British Columbia by updating information from the 2001 and 2002 fishing seasons; *(ii)* provides analyses and recommendations for limit and target reference points for the 2003-2004 and 2004-2005 fishing seasons; and *(iii)* presents results from fishery-independent surveys of green sea urchins conducted in B.C., Canada. Reference points are determined using biomass dynamic models applied to the core stocks in the B.C. south coast: Queen Charlotte Strait (Pacific Fisheries Management Areas 11-13) and the Gulf Islands (PFMA 17-20, 28). Two methods are used to determine the parameters of these models: a linear approximation to the dynamic Schaefer model, and a time series fitting method. For both core stocks, both models produce similar (i.e. overlapping 95% confidence intervals) estimates of the maximum sustainable yields (MSY). The time series fitting method produces a lower MSY with narrower confidence intervals for the smaller stock (Gulf Islands region), and it is recommended as the more conservative method for calculating reference points. The calculated MSYs are recommended as limit reference points. A Bayesian approach to a state-space model is developed to incorporate uncertainties in both the observations from the fishery and in the specification of the surplus production model, and to include information from the fishery-independent surveys. The result of this model is a probability distribution for MSY, which can be used to assist with the

choice of target reference points (TRPs) for this fishery. Target reference points for both core regions in the south coast combined are in the range of 101.5 to 203.1 t. Target reference points in this range have a very low probability (<3%) of including the actual MSY (the limit reference point), according to the Bayesian model developed here. Fishery-independent surveys have been conducted annually since 1995 at index sites in Area 12 (Queen Charlotte Strait) and indicate that the biomass of green urchins in this area in 2001 and 2002 were among the highest observed for legal-sized urchins.

Working Paper I2003-03: Utility of using historical catch to set reference points for the British Columbia shrimp trawl fishery

D.T. Rutherford, L.L. Barton, G.E. Gillespie, J.A. Boutillier

This paper focused on the utility of using historical catch to set reference points for the shrimp by trawl fishery. These data were reviewed and determined to be not suitable as a proxy for abundance (key assumption in using historical catch in reference point models). Historical catch data have no resolution to species or current management area and have no supporting information to provide assurances of no stock decline during the historical time period. Even in the event that historical catch was suitable (i.e. did index abundance) as input into reference point models, the shrimp fishery has undergone profound change and historical catch does not reflect the current fishery. These changes include size and species specific targeting by the shrimp by trawl fleet.

The current assessment and management framework utilizes fishery independent survey methods to estimate shrimp biomass in selected Shrimp Management Areas (SMA's). Annual catch limits in surveyed SMA's are set based on applying a harvest rate to the estimated biomass. Annual catch limits in the non-surveyed SMA's are set through two different methods. For some SMA's biomass is indexed through extrapolation procedures using neighbouring survey sites. For all non-indexed sites arbitrary catch ceilings are set by fish managers.

The paper recommends continuation and improvements to the current assessment framework. The paper also strongly recommends against using historical catch data as proxy for abundance in reference point models.

Working Paper I2003-04: Development of a new fishery for tanner crabs (*Chionoecetes tanneri* Rathbun, 1893) off British Columbia: 2003 status report

G.E. Gillespie, K.H. Fong, A.C. Phillips, G.R. Meyer, J.A. Boutillier

The primary purposes of this paper are to present information gathered since the last report (Workman *et al.* 2000), to identify information needs and present proposals for future work to meet these information needs. The specific objectives of this paper are:

1. To delineate the distribution of Tanner crabs off the British Columbia coast, and examine potential areas which might support a commercial fishery;
2. To examine the impacts of a directed Tanner crab trap fishery on both Tanner crabs and other species that are caught incidentally;
3. To examine total impacts on the Tanner crab resource from all fisheries;
4. To critically examine assessment methodology and biological assumptions used to date; and
5. To make recommendations for the continued development of deep water Tanner crab fisheries off British Columbia.

APPENDIX 2: PSARC Invertebrate Subcommittee Meeting Agenda June 17-19, 2003

Seminar Room, Pacific Biological Station, Nanaimo, B.C.

	17 June **Tuesday** Start 0900	**18 June** **Wednesday** Start 0900	**19 June** **Thursday** Start 0900
AM 1	Introductions and Procedures **I2003-02** Assessment of Green Sea Urchin (*Strongylocentrotus droebachiensis*) in British Columbia, 2003 Stock Status Report Green Sea Urchin	Introductions and Procedures **I2003- 03** Implications of using historical catch to set reference points in the British Columbia shrimp by trawl fishery	Unfinished business from Days 1 and 2. Rapporteur's Report Day 2
Break			
AM 2	**I2003-01** Progressing to a scientifically-based assessment and management system for renewed commercial pink and spiny scallop fisheries off the British Columbia Coast	Rapporteur's Reports Day 1	Emerging Issues and Committee recommendations Finalize committee report.
Lunch			
PM 1	I2003 – 03 continued **I2003- 04** Development of a new fishery for Tanner crabs (*Chionoecetes tanneri* Rathbun, 1893) off British Columbia: 2003 status report.		**Working Papers for November 2003**
Break			
PM 2	I2003-04 continued		

APPENDIX 3: List of Attendees & Reviewers

Subcommittee Chair: Kim West
PSARC Chair: Al Cass

DFO Participants	Tues.	Wed.	Thurs.
* Subcommittee Members			
L. Barton	x		
J. Boutillier*			x
B. Bornhold*	x	x	x
A. Campbell*	x	x	x
A. Cass (PSARC Chair)	x	x	x
D. Clark	x	x	x
L. Convey		x	x
A. Drinkwater	x	x	x
K. Fong	x	x	x
G. Gillespie*	x	x	x
C. Hand*	x	x	x
R. Harbo*			x
R. Lauzier*	x		
J. Lessard	x		
R. McNicol		x	
J. Morrison	x		
R. Mylchreest*	x	x	x
G. Parker*	x	x	x
I. Perry*	x	x	x
J. Rogers*	x	x	x
D. Rutherford	x	x	x
D. Tzotzos		x	x
B. Waddell	x		
K. West* (Chair)	x	x	x
E. Wylie	x	x	x
Z. Zhang	x	x	x

External Participants:	Tues.	Wed.	Thurs.
M. Callow (West Coast Green Sea Urchin Assoc.	x		
A. Miles (Haisla Fisheries Commission		x	
L Richards (West Coast Scallop Harvesters Assoc.)	x		
D. Smith (Ministry of Agriculture, Food and Fisheries	x		

Reviewers for the PSARC papers presented at this meeting are listed below, in alphabetical order. Their assistance is invaluable in making the PSARC process work.

Davidson, L.	Fisheries and Oceans Canada, Gulf Region
Jamieson, G.	Fisheries and Oceans Canada
Parker, G.	Fisheries and Oceans Canada
Pearce, C.	Fisheries and Oceans Canada
Perry, I.	Fisheries and Oceans Canada
Smith, S.	Fisheries and Oceans Canada, Maritimes Region

Table 1. Calculations of limit and target reference points for green sea urchins in South Coast management areas, derived from the time series fitting surplus production method. The ranges of quota options recommended for the 2003-2004 and 2004-2005 fishing seasons are in boldface. The MSY for PFMA 11-13 is 320 t. The MSY for PFMA 17-20, 28 is 86 t.

	Pacific Fishery Management Area – South Coast – inside waters												
	11	12	13	14	15	16	17	18	19	20	28	29	Total
Proportion of GSU caught (1995-2002) of the total catch for each Region (PFMA 11-13 and PFMA 17-20,28)	.010	.636	.353				.01	.415	.447	.134	0		
MSY (t)	3.2	203.5	113.0				0.9	35.7	38.4	11.5	0		406.2
Precautionary reduction 0.5 * MSY (t)	**1.6**	**101.8**	**56.5**				**0.4**	**17.9**	**19.2**	**5.7**	**0**		**203.1**
Precautionary reduction 0.35*MSY (t)	**1.1**	**50.9**	**39.5**				**0.3**	**12.5**	**9.6**	**2.9**	**0**		**142.1**
Precautionary reduction 0.25*MSY (t)	**0.8**	**50.9**	**28.2**				**0.2**	**8.9**	**9.6**	**2.9**	**0**		**101.5**